



APPENDIX, GLOSSARY, AND BIBLIOGRAPHY

APPENDIX A: SSP FULL-COST METHODOLOGY

ELEMENTS OF A FULL-COST MODEL

Figure A.1 graphically displays our general approach to estimating the full cost of the Space Shuttle Program. Conceptually, the cost of a product or service would be the sum of four sets of factors:

- Direct costs—extramural contracts, civil service personnel, and facilities costs
- Indirect costs—indirect civil service personnel and facilities, center and HEDS support contracts
- G&A—senior management, functional support (e.g., contracting, procurement, human resources, etc.).
- Overhead—center maintenance and operations

The Task Force drew from many different databases in order to populate this estimation model. Cost information was drawn largely from known contracts costs and formal budget documents, both published (i.e., the President's Budget submission for FY03) and internal (NASA internal budget and financial management databases at varying levels of detail). Civil service personnel were identified through several NASA internal databases, including a workforce data cube maintained by the Human Resources office at NASA Headquarters, data produced during the Strategic Resource Review exercise conducted during 2001, and center phonebooks. Facilities information was drawn from NASA's Real Properties database.

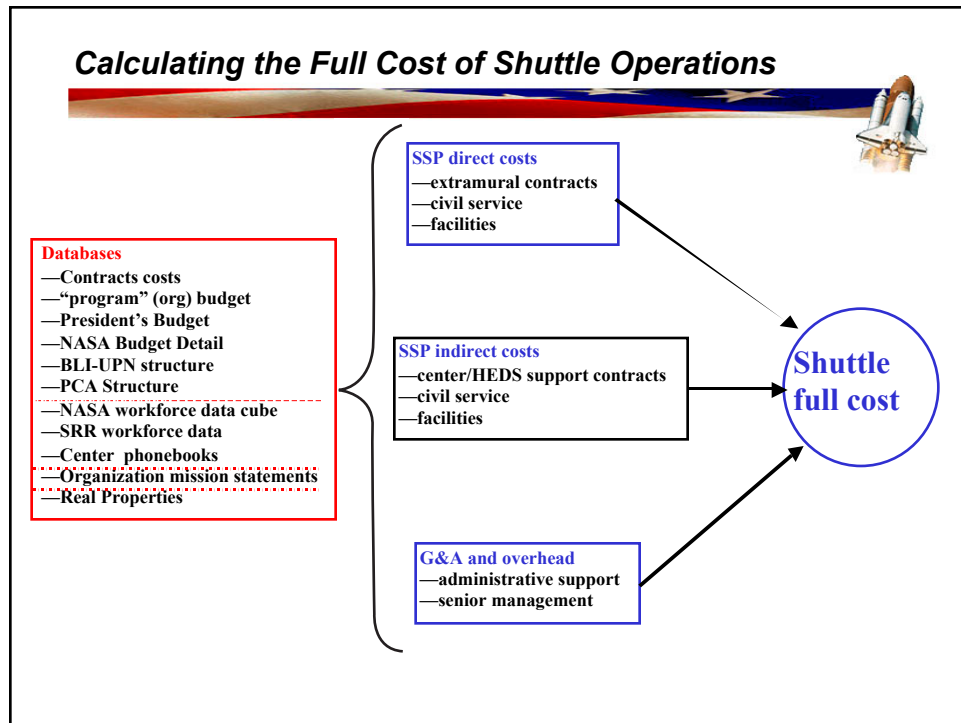


Figure A.1

Discussions with NASA officials at both headquarters and field centers supplemented the information derived from these various databases, and helped ensure that our interpretation of the resulting analysis was credible and valid within the limits of the databases. With the exception of one supporting estimate conducted during fall 2001, the Task Force used program and budget documentation for FY03.

ESTIMATING SSP FULL COST

The Task Force's best estimate of Shuttle full costs is \$3.8 billion annually. This subsection describes the specific method used to derive that estimate. As stated above, the Task Force began by dividing costs into direct, indirect, G&A, and overhead categories. This was essentially a bottom-up approach.

The vast majority of Shuttle program costs—\$3.2 billion annually—are extramural costs. These are the direct contract costs for Shuttle operations and include the major contracts to USA, Boeing, Lockheed Martin, and Thiokol. While the Task Force could have used any one of a number of

NASA budget databases showing annual Shuttle budgets, it chose to use the slightly different accounting structure used by the Shuttle Program Office to manage program finances.¹ This database is closer to actual cost than the available budget data. One important virtue of this database is the implicit use of a fairly detailed work breakdown structure, which the Task Force then borrowed and supplemented as needed to introduce other cost elements.

Indirect, G&A, and overhead costs were more difficult to estimate because NASA does not track costs or budgets in this way. Differences among the estimates the Task Force produced (see next section below) or differences with other estimates of Shuttle full cost result mainly from different assumptions regarding what goes into these categories.

There are several assumptions underlying this approach. First, the Task Force assumed that G&A and overhead can be allocated to programs based on the ratio of direct SSP dollars to total NASA dollars at each center. Second, it assumed that civil service labor costs could be estimated by identifying Shuttle-related personnel in each office/organization at each of the four Shuttle centers (JCS, KSC, MSFC, and SSC).

Civil service costs account for the majority of the difference between the \$3.2 billion in direct contract costs and the \$3.8 billion estimated full cost. NASA phonebooks were used to identify relevant offices, and the number of people in each office. Headquarters HEDS personnel were allocated back to three centers (JSC, KSC, and MSFC) based on an allocation heuristic developed by the Task Force (80 percent, 15 percent, and 5 percent, respectively). The NASA Headquarters Human Resources Office provided salary and demographic information for each person currently listed in the center organizations of interest, with appropriate protections for sensitive personnel data. Based on the judgment of Task Force members, the proportion of each office directly or indirectly related to Shuttle operations was estimated. Thus, if an office's activities were determined to be 60-percent Shuttle related, then 60 percent of the combined salaries of all individuals in that office would be included in the estimate. The Task Force applied a 26-percent burden rate to salary to get an estimate of the full cost of personnel; this rate is the same as used for competitive sourcing under A-76 rules. The center organizations and their associated Shuttle personnel costs were regrouped into functional areas that could then be placed in the appropriate cost element of the work breakdown structure.

¹This database was provided by the SSP Business Office at NASA JSC upon request. The data were provided as an Excel spreadsheet entitled Content Total Shuttle Program.

Research Operations Support, representing base operations and maintenance costs was allocated to the Shuttle program based on the ratio of program direct costs at each center to the total NASA funds associated with each center's operations and programs.

The final full-cost estimate resulted in a \$3.8 billion figure, putting it at the lower threshold of the previous estimates. The approach used to get that result draws from several different databases, each of which has embedded in it a set of assumptions and an approach or method that generated the data. Data sources are:

1. Workforce exercise: this approach used the NASA phonebooks at JSC, KSC, SSC, and MSFC to identify each civil servant in each organization, mapped that to a human resource file from NASA HQ that gave salary info, allocated a percentage of the total personnel in each organization to the Shuttle based on the Task Force's assessment, and then regrouped these organizations to better fit the work breakdown structure adopted from the cost file provided by the SSP Business Office.
2. Facilities data also include data on the number of FTE in each building; the Task Force made some assumptions about which buildings are Shuttle related, and if mixed use, how much can be attributed to Shuttle.
3. The published FY03 President's Budget Request. These data were used as the source for the payload carrier's account, as well as the critical assumption about allocating indirect civil servants at the four centers (the ratio of SSP direct dollars to total dollars at each center—see #1 above).
4. A "cost" file provided by the SSP Business Office at JSC, which reflects the way the SSP accounts for and tracks expenditures. The Task Force mostly adopted the supplied data, though individual items often moved to other categories to better reflect a true Work Breakdown Structure. These are cost figures, not budget figures; the SSP Business Office stated that they would be very close to budget figures in most cases (and they were), but not precisely the same in every item.
5. Budget detail provided by NASA's Office of the Chief Financial Officer. This was the entire HEDS (or Human Space Flight [HSF]) appropriation at what NASA calls Object Level Four. These data included separate lines for personnel, travel, and procurement costs, as well as an FTE estimate for each line item. Account and program titles included in this file allowed the Task Force to identify each HEDS/HSF program. Crosschecks indicated that the dollar figures

were consistent with contract databases the Task Force obtained, as well as with the published FY03 President's Budget.

6. Estimate from a NASA Office of Space Flight official for data and communication services "bought" by SSP. These numbers are for FY01.

An important caveat is that the underlying assumptions across these different data sources and approaches are not necessarily consistent. The workforce exercise results in a number of civil servants that is different than the President's FY03 budget, the FTE indicated in the budget detail file, and the numbers generated by NASA in their Strategic Resources Review. This methodological inconsistency suggests that the \$3.8 billion estimate for Shuttle full cost should be interpreted as a rough estimate with a potentially large variance. The full-cost model itself, however, is valuable as a description of the elements of a full-cost estimate and as a demonstration that such estimates can be performed with data available to NASA.

OTHER APPROACHES AND ESTIMATES SUPPORTING SSP FULL-COST DETERMINATION

Prior to developing our final estimate for Shuttle full cost described above, the Task Force developed several other full-cost estimates using different databases and different assumptions. Interestingly, all four of these estimates were close to \$4.0 billion in annual costs. The Task Force then bounded these estimates with +/- \$200 million due to known uncertainties in data and assumptions. While the Task Force did not formally use these estimates in the analysis, the estimates did help the Task Force to identify the components of a full-cost model and provided a rough estimate of where the Task Force would end up after performing the more detailed work-up estimate. These were essentially top-down approaches to estimating full cost. All of these approaches use budget as a proxy for cost.

Approach 1

This estimate, developed in order to gain insight into the full cost of the ISS, uses the FY02 President's Budget and follows a methodology similar in its general elements. ISS utilization costs were transferred to Code U accounts, and the budget for academic programs was distributed across NASA. Institutional support associated with the HEDS enterprise was broken out based on data in the FY02 budget documents, then distributed, along with the SR&QA and space operations budgets across NASA field

centers. The result for HEDS is shown in Table A.1; Figure A.2 presents the results for all of NASA. For this estimate, the Task Force grouped HEDS activities into four basic programs, allocating institutional, SR&QA, and space operations costs as appropriate. Each program estimate includes direct, indirect, general and administrative, and overhead costs.²

Table A.1
Full-Cost Allocation of HEDS Budget to Programs (millions, then-year dollars)

Human Space Flight	\$6,608.0
International Space Station	33.6%
Space Shuttle	60.5%
Payload and ELV Support	2.5%
HEDS Research	3.4%

Though the study itself was focused on the ISS, the Task Force needed to fully allocate all direct and indirect NASA costs to HEDS and the other four NASA enterprises. Figure A.2 shows that in full-cost terms, HEDS is by far the largest enterprise, and the Shuttle program is the largest single program at NASA.

²Key assumptions here include: all SR&QA and Rocket Engine Support funds are allocated to the Shuttle; and HEDS is allocated 39.9 percent of the Space Operations budget, which in turn is allocated to SSP, ISS, and payload and ELV at 40 percent, 55 percent, and 5 percent, respectively.

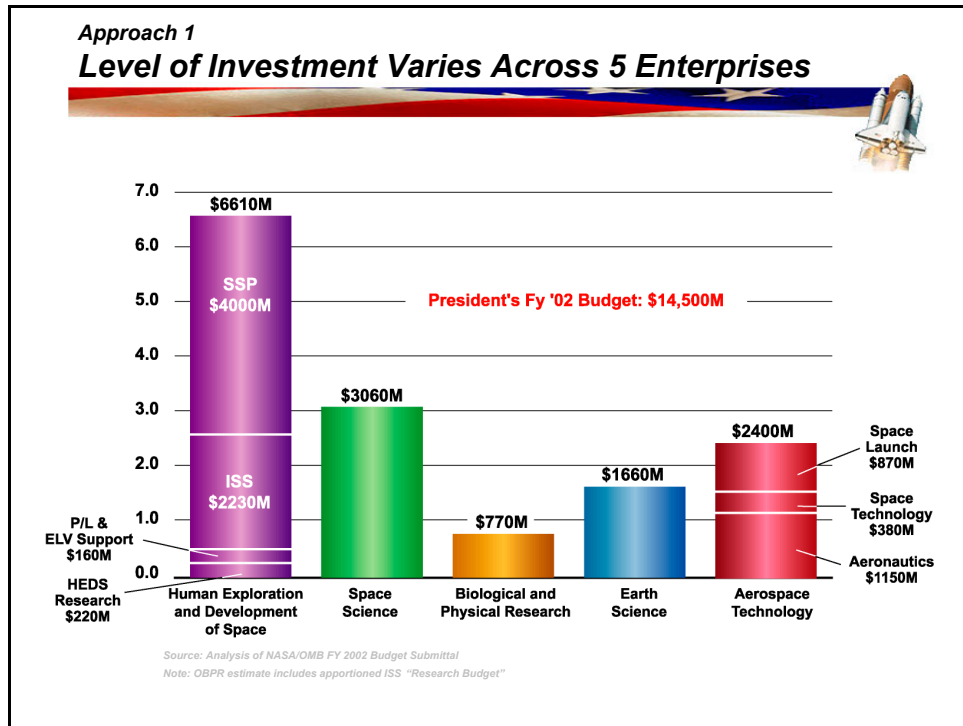


Figure A.2

Approach 2

This estimate used the President's FY03 budget documents to derive an estimate for Shuttle full cost. Shuttle direct costs are easily identified in the budget. The Task Force assumed that payload carriers and support were entirely Shuttle, and so added it to Shuttle direct.³ The Task Force then simply took 50 percent of the remaining costs in the HSF account and allocated those to Shuttle. The result is a full-cost estimate of \$3.9 billion.

³This is the same assumption used in Approach 4 below and the final estimate discussed above.

Approach 2

Elements of a Shuttle Budget, March 02



	2001 revised op plan	2002 initial plan	2003 Pres Budget	FY03 Shuttle Full Cost
Space Shuttle	3118.8	3272.8	3208.0	3928.5
Flight Hardware	1970.6	2028.1	1844.3	1844.3
Ground Operations	581.6	610.9	589.3	589.3
Flight Operations	273.0	238.0	266.6	266.6
Program Integration	293.6	395.8	507.8	507.8
Payload and ELV Support	90.0	91.3	87.5	
Payload Carriers and Support	56.9	57.0	51.7	51.7
HEDS Investment and Support	1247.8	1214.5	1172.4	586.2
Space Communications and Data Systems	521.7	482.2	117.5	58.8
Safety, Mission Assurance and Engineering	47.4	47.6	47.6	23.8

Source: President's FY03 Budget

Figure A.3

Approach 3

This approach again used the President's FY03 Budget to produce an estimate of Shuttle full cost. The difference between this approach and Approach 2 above is the assumption for allocating indirect costs. As shown below in Figure A.4, indirect costs for communications and data, Safety and Mission Assurance, HEDS Investment and Support, and Research and Program Management (R&PM) were allocated using the average proportion of HSF appropriations accounted for by Shuttle direct costs over the period FY00–FY07: 53 percent. Additionally, direct R&PM budget for the Shuttle is identified in the President's FY03 Budget and was used directly. The result is a Shuttle full cost estimate approaching \$3.9 billion annually.

Approach 3

Bounding the Problem, April 02



	millions FY\$	
	FY2003 Budget	Cumulative Budget
Space Shuttle Program	3208.0	3208.0
Payload Carriers	51.7	3259.7
R&PM (direct)	282.1	3541.8
Space comm and data (indirect)	61.5	3603.3
S&MA (indirect)	24.9	3628.2
Other HEDS I&S (non-R&PM)	94.7	3722.9
R&PM (indirect)	250.5	3878.7

Note: based on FY03 President's Budget. Assume payload carriers 100% shuttle. SSP direct personnel costs based on direct FTE (1920) times average salary (HEDS R&PM divided by total HEDS FTE (6786). Use average value of SSP direct budget as proportion of total HSF appropriation FY00-FY07 (53%) to allocate other indirect costs.

SSP Business Office full cost estimate for FY03: \$3624M

Figure A.4

Figure A.4 also shows an estimate made by the Shuttle Business Office, which developed a full-cost estimate totaling \$3.6 billion. Differences in assumptions regarding indirect costs account for the difference between this estimate and the four supplemental estimating approaches here.

Approach 4

The final supporting estimate developed by the Task Force was based entirely on a detailed breakdown of the HSF budget.⁴ This database included all program and support budgets in HSF—budget line items (BLIs). Each data element was broken down into number of FTE, personnel costs,⁵ travel costs, and procurement costs; this is known as Objective Level 4 in the budget. Thus there are really four separate databases here, one detailing the allocation of civil servants across HSF programs and support accounts, and three allocating HSF budgets across

⁴These data were provided by Headquarters Code B upon request.

⁵The Task Force assumed that the personnel costs are “fully loaded”; they contain costs associated with benefits and other overhead costs not accounted for elsewhere.

those same programs and support accounts. The beauty of this approach is in its relative simplicity and consistency. The Task Force found enough detail to estimate Shuttle direct and indirect costs by program, while the number of assumptions needed is minimal.

The Task Force first sorted the data into its four component parts. The Task Force then assumed that there were only four programs in HEDS: Space Station, Space Shuttle, ELV mission support, and HEDS research. All program direct and indirect costs must be allocated to these four programs for each BLI element (FTE, procurement, travel, and personnel). After allocating indirect costs separately, the procurement, travel, and personnel budgets can then be aggregated for each program to produce an estimated total budget. Again, the Task Force used FY03 data corresponding to the FY03 budget submission.

The Task Force sorted the data by BLI and summed the individual program elements to get a total for FY03. Using information in the program title data element, the Task Force identified ELV mission support budgets and subtracted that from the payload utilization and operations BLI. The Task Force then added the remaining budget element (payload carriers) to Shuttle direct.⁶ It then identified HEDS research using the program titles and subtracted that from the HEDS institutional support BLI. The Task Force then calculated total HSF direct program costs by adding ISS, SSP, ELV mission support, and HEDS research. The remaining budget accounts were summed to derive a total indirect budget pool. The Task Force then calculated the ratio of program direct costs to total direct costs, and used that ratio as a multiplier to allocate indirect costs to the four programs. The result was a full estimate for each of the four HSF programs. This was done for each data element—FTE, procurement, personnel, and travel. The full-cost program totals were then added to derive the combined full-cost total of each program. Crosschecks were performed on both interim and final results to ensure that estimates added up to known budgets.

The following charts provide the results of these steps for each data element and in total.

⁶This assumption was validated by headquarters personnel. There remains some debate about whether payload carrier costs should be allocated to Shuttle direct or to the users of the Shuttle who need carriers in order to secure their payloads for flight.

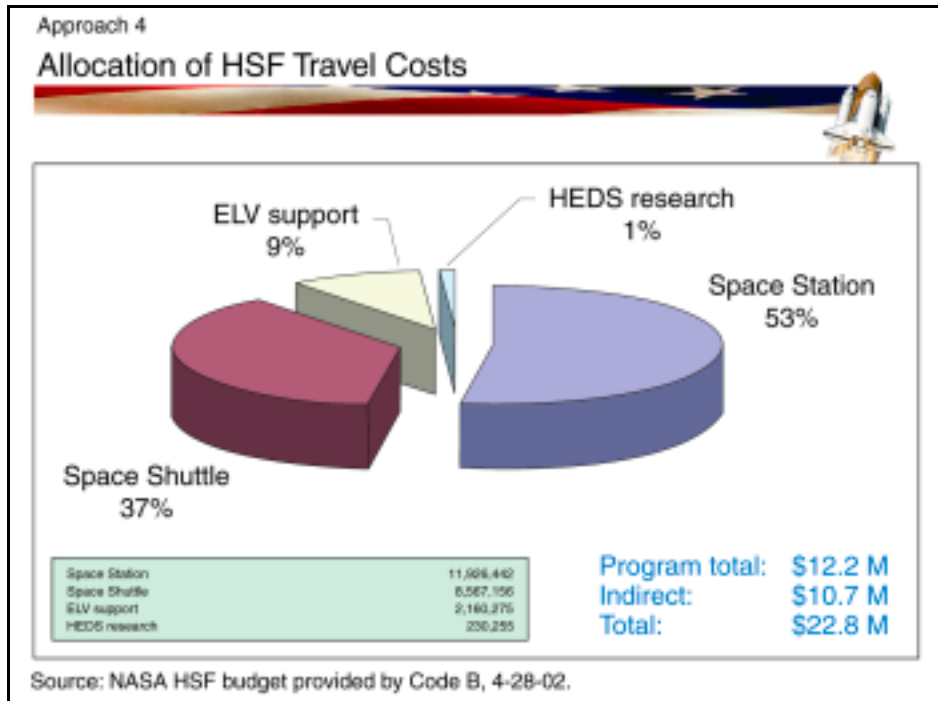


Figure A.5

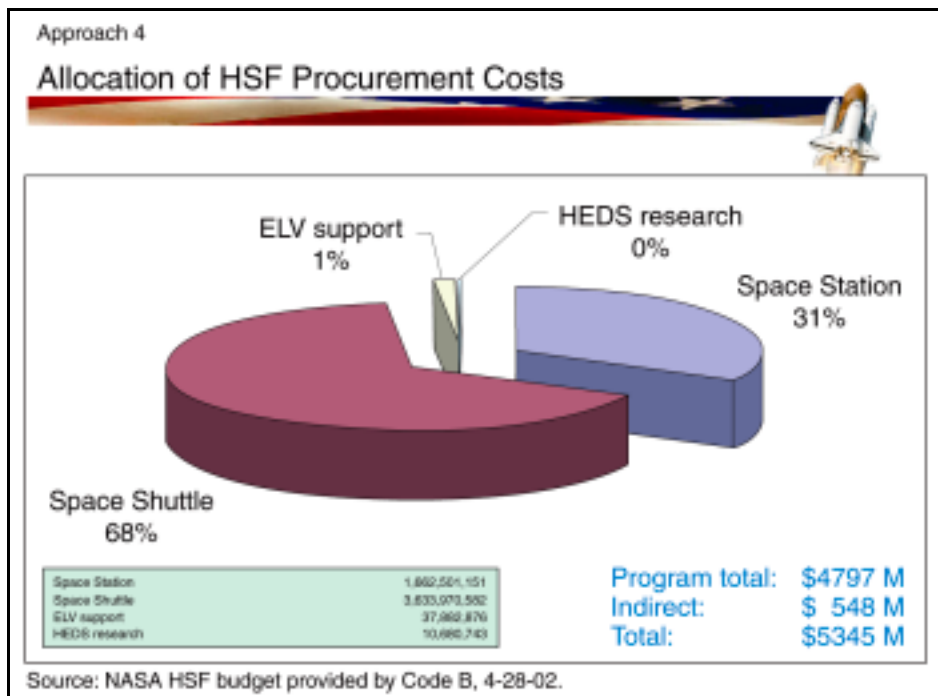
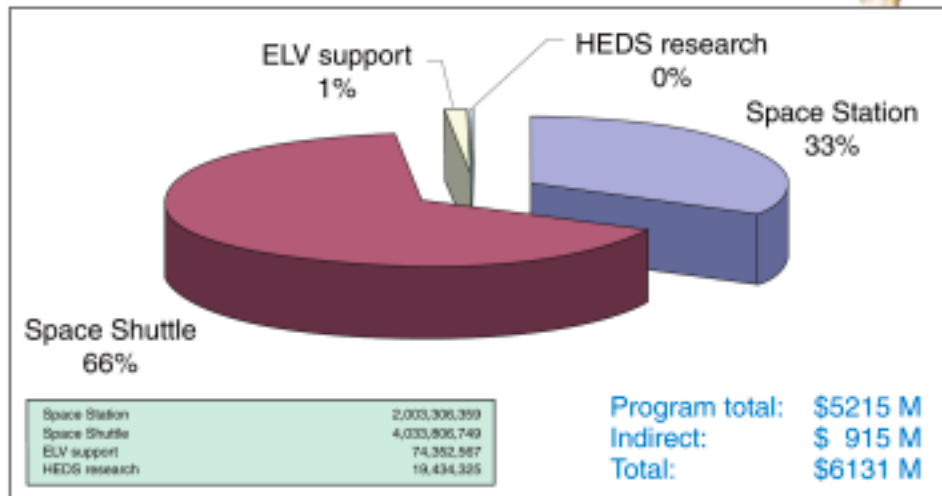


Figure A.6

Approach 4

Allocation of All Costs Among HEDS Programs



Source: NASA HSF budget provided by Code B, 4-28-02.

Figure A.7

APPENDIX B: INFRASTRUCTURE DATABASE METHODOLOGY

Compiling the infrastructure database utilized in this study involved a six-step process. The first step required acquiring property-listing reports for each field center and site from the NASA Real Property Inventory.⁷ In sum, nearly 90 separate property listing reports were acquired by the Task Force. These reports were then merged into a master worksheet that contained the space agency's entire collection of real property. The information in this database populated the columns in *Appendix F* entitled System ID, Number (#), Name, Status, Book Value, 2002 CRV, Capacity, and 1st Year. With regard to the NASA Real Property Inventory, these terms have the following meanings:

- **System ID:** the identification number given to a particular facility for purposes of tracking all NASA property.
- **Number (#):** the identification number given to a particular facility for purposes of tracking NASA property at a specific field center or site.
- **Name:** the name given to a particular facility for purposes of identification.
- **Status:** denotes whether the facility is active or has been categorized in some other mode (e.g., abandoned, mothballed, heritage, standby).
- **Book Value:** how much a facility cost to build in current-year dollars, adjusted for subsequent maintenance and upgrades.
- **2002 CRV:** current replacement value is derived for a given facility utilizing a 20-city average found in the construction economics section of *Engineering News Magazine*. The CRV takes into account the type and size of a facility, and based on that data estimates what it would cost to replace the facility in 2002 dollars.
- **Capacity:** the size of the facility, measured using a variety of metrics ranging from square feet to acres.
- **1st Year:** the year that the facility was commissioned and began operations.

⁷National Aeronautics and Space Administration, Office of Management Systems, Facilities Engineering Division, *NASA Real Property Inventory/Facility Utilization*.

Two additional columns were created within the database that identified the field center and site for each facility. The next task was to create individual worksheets for each of the field centers carrying out Shuttle-related activities. It was assumed that if there were no Shuttle personnel working at a field center or site, that no Shuttle-related activities were carried out there—these centers and sites were omitted from the analysis. In addition, abandoned and mothballed facilities were removed from these field center worksheets, based on the assumption that these facilities were not crucial to an operational Shuttle system.

The second step necessitated gathering data inputs from the relevant field centers that detailed which facilities were utilized by the Shuttle program and to what extent they were used (either a 100-percent Shuttle facility or a multiprogram facility used by the Shuttle program). Each field center submitted data, which were then integrated into the master infrastructure database as a column indicating NASA's estimate of Shuttle program usage. Two additional columns were added to indicate the adjusted Shuttle portion of facility book values and current replacement values. Thus, if a CRV for a particular facility was \$100 and it was a 50-percent Shuttle facility, then the CRV was adjusted to \$50. For every field center except KSC, the NASA estimates for percentage of Shuttle use were accepted. For KSC, however, a large number of crucial Shuttle facilities were listed as institutional facilities or an estimate regarding the percentage of Shuttle use was not provided. Another column was inserted in the database for the RAND estimate of the percentage of Shuttle use for this group of KSC facilities. For the former group, each of the facilities was listed as a 100-percent Shuttle facility because it was not used by any other program (e.g., VAB, launchpads). For the latter group, each of the facilities was listed as a 60-percent Shuttle facility (this number was derived by using the Shuttle portion of the total KSC annual budget). This step concluded with the insertion of two columns to show the adjusted Shuttle percentage of book value and current replacement value at KSC.

The third step entailed acquired building space utilization reports for each field center and site from the NASA Facility Utilization System.⁸ These data were then merged into the master infrastructure database in four columns. The first indicated the number of civil servants working in a specific facility, the second the number of contractors, the third the number of other persons, and the fourth the total number of persons working in each facility. After inserting these data, two additional columns were added. These two columns apportioned the civil servants

⁸National Aeronautics and Space Administration, Office of Management Systems, Facilities Engineering Division, *NASA Real Property Inventory/Facility Utilization*.

and contractors to the Shuttle program based on the percentage of Shuttle use for a particular facility. Thus, if a facility had ten civil servants working in it and it was a 50-percent Shuttle facility, five of those civil servants were considered Shuttle employees.

The fourth step necessitated gathering data inputs from the relevant field centers (with the exception of WSTF) that detailed the amount of BMAR for each facility. BMAR indicates the amount of funding required to properly maintain a particular facility that has not been previously budgeted. JSC, MSFC, SSC, and KSC submitted Excel worksheets with this data, which was then integrated into the master infrastructure database as a column indicating the level of BMAR for a particular facility. DFRC and the Michoud Assembly Facility (MAF) both provided estimates of the BMAR for the entire center or site. These total numbers were apportioned among the facilities based on the percentage of total CRV that a particular facility represented (e.g., if the center BMAR was \$100 and a given facility represented 1 percent of the total CRV for the center, \$1 of BMAR was apportioned to that facility). The final task was to add another column that allocated the BMAR for each facility to the Shuttle program. Thus, if a facility had \$100 in BMAR and was a 50-percent Shuttle facility, \$50 of BMAR was allocated to the Shuttle program.

The fifth step involved analyzing the NASA Financial and Contractual Status (FACS) database to determine the annual operating costs for each facility.⁹ This analysis was conducted for the four largest Shuttle centers (JSC, KSC, MSFC, and SSC). An estimate of the total operations costs for each center was derived by summing every base maintenance and operations contract at that particular field center. Then, this total was apportioned among each facility as a function of the percentage of CRV represented by that facility. Thus, if the total base maintenance and operations contracts let at a given field center was \$100, and a particular facility accounted for 1 percent of the field center's total CRV, then \$1 of operating costs was allocated to that facility. Finally, another column was added that allocated the operating costs for each facility to the Shuttle program. Thus, if a facility had \$100 in operating costs and was a 50-percent Shuttle facility, \$50 in operating costs were allocated to the Shuttle program.

The final step entailed estimating the annual cost for each facility (this proved to be more accurate at the four largest Shuttle field centers because operating costs were available for those centers). To estimate the annual

⁹National Aeronautics and Space Administration, Office of Procurement, *NASA Financial and Contractual Status (FACS) System*, Washington, DC, 2001.

cost for a particular facility, the operating costs were added to the labor costs for that facility. Based on an analysis of Shuttle personnel, RAND determined that the average NASA civil servant salary was \$106,000. For a particular facility, that average salary was multiplied by the number of Shuttle-related civil servants that were working in the facility, which provided the civil servant labor cost for the facility. Utilizing \$120,000 as the average salary for contractors (a common figure used in similar analyses), RAND used the same method to calculate the contractor labor cost for each facility. The sum of these three figures (civil servant labor, contractor labor, and operating costs) represented the estimated annual cost to run a given facility. Thus, for a facility with ten civil servants ($10 \times \$106,000 = \$1,060,000$), ten contractors ($10 \times \$120,000 = \$1,200,000$), and operating costs of \$140,000, the annual cost of running that facility would be \$2.4 million.

GLOSSARY

GENERAL

Commercialization—divestiture through service shedding occurs when the government reduces the level of service provided or stops providing a service altogether. Private-sector businesses or nonprofit organizations may then step in to provide the service if there is a market demand. (Source: GAO/GGD-97-121, 1997)

Competitive Sourcing—a tool for lowering the cost and/or improving the performance of public tasks by exposing those tasks to the discipline of commercial competition. Requiring public employees who perform commercially available tasks to compete for the right to continue the work can improve efficiency either by replacing public incumbents with commercial alternatives, or by motivating the public incumbents to attain or exceed the efficiency standards of the competitive private sector. (Source: interpreted from President's Management Agenda, FY2002)

Municipalization—to place an appropriate activity or infrastructure under local government control and/or ownership and by using municipal powers create benefits for the activity, infrastructure as well as the users. (Florida Spaceport Authority)

Privatization—any process aimed at shifting functions and responsibilities, in whole or in part, from the government to the private sector. (Source: GAO/GGD-97-121, 1997)

ACQUISITION

Acquisition—the acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the federal government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly

related to the process of fulfilling agency needs by contract. (Source: *Federal Acquisition Regulations, Part 2.101*)

Best Value—the expected outcome of an acquisition that, in the government’s estimation, provides the greatest overall benefit in response to the requirement. (Source: *Federal Acquisition Regulations, Part 2.101*)

Commercial Activity—those activities that the government performs with its employees or resources but could obtain from private-sector sources. Commercial activities are in contrast to “inherently governmental” activities. (Source: *GAO/GGD-97-121, 1997; OMB Circular A-76, revised 1999*)

Contract—a mutually binding legal relationship obligating the seller to furnish the supplies or services (including construction) and the buyer to pay for them. It includes all types of commitments that obligate the government to an expenditure of appropriated funds and that, except as otherwise authorized, are in writing. In addition to bilateral instruments, contracts include (but are not limited to) awards and notices of awards; job orders or task letters issued under basic ordering agreements; letter contracts; orders, such as purchase orders, under which the contract becomes effective by written acceptance or performance; and bilateral contract modifications. Contracts do not include grants and cooperative agreements covered by 31 U.S.C. 6301, et seq. (Source: *Federal Acquisition Regulations, Part 2.101*)

Cost-plus-award-fee Contract—a cost-reimbursement contract that provides for a fee consisting of a base amount (which may be zero) fixed at inception of the contract and an award amount, based upon a judgmental evaluation by the Government, sufficient to provide motivation for excellence in contract performance. (Source: *Federal Acquisition Regulations, Part 16.3*)

Cost-plus-fixed-fee Contract—a cost-reimbursement contract that provides for payment to the contractor of a negotiated fee that is fixed at the inception of the contract. The fixed fee does not vary with actual cost, but may be adjusted as a result of changes in the work to be performed under the contract. This contract type permits contracting for efforts that might otherwise present too great a risk to contractors, but it provides the contractor only a minimum incentive to control costs. (Source: *Federal Acquisition Regulations, Part 16.3*)

Cost-plus-incentive-fee Contract—a cost-reimbursement contract that provides for an initially negotiated fee to be adjusted later by a formula based on the relationship of total allowable costs to total target costs. (Source: *Federal Acquisition Regulations, Part 16.3*)

Cost-reimbursement Contract—a contract that provides for payment of allowable incurred costs, to the extent prescribed in the contract. These contracts establish an estimate of total cost for the purpose of obligating funds and establishing a ceiling that the contractor may not exceed (except at its own risk) without the approval of the contracting officer. (Source: *Federal Acquisition Regulations, Part 16.3*)

Cost Contract—cost-reimbursement contract in which the contractor receives no fee. (Source: *Federal Acquisition Regulations, Part 16.3*)

Direct Cost—a direct cost is any cost that can be identified specifically with a particular final cost objective. No final cost objective shall have allocated to it as a direct cost any cost, if other costs incurred for the same purpose in like circumstances have been included in any indirect cost pool to be allocated to that or any other final cost objective. Costs identified specifically with the contract are direct costs of the contract and are to be charged directly to the contract. All costs specifically identified with other final cost objectives of the contractor are direct costs of those cost objectives and are not to be charged to the contract directly or indirectly. (Source: *Federal Acquisition Regulations, Part 32.202*)

Firm-Fixed-Price Contract—provides for a price that is not subject to any adjustment on the basis of the contractor's cost experience in performing the contract. This contract type places upon the contractor maximum risk and full responsibility for all costs and resulting profit or loss. It provides maximum incentive for the contractor to control costs and perform effectively and imposes a minimum administrative burden upon the contracting parties. (Source: *Federal Acquisition Regulations, Part 16.2*)

Firm-Fixed-Price, Level-of-Effort Term Contract—requires: the contractor to provide a specified level of effort, over a stated period of time, on work that can be stated only in general terms; and the government to pay the contractor a fixed dollar amount. (Source: *Federal Acquisition Regulations, Part 16.2*)

Fixed-Price Incentive Contract—a fixed-price contract that provides for adjusting profit and establishing the final contract price by a formula based on the relationship of final negotiated total cost to total target cost. (Source: *Federal Acquisition Regulations, Part 16.2*)

General and Administrative (G&A) Expense—(an indirect cost associated with) any management, financial, and other expense which is incurred by or allocated to a business unit and which is for the general management and administration of the business unit as a whole. G&A expense does not include those management expenses whose beneficial or causal relationship to cost objectives can be more directly measured by a

base other than a cost input base representing the total activity of a business unit during a cost accounting period. (*Source: Federal Acquisition Regulations, Part 2.101*)

Incentive Contracts—utilized when a firm-fixed-price contract is not appropriate and the required supplies or services can be acquired at lower costs and, in certain instances, with improved delivery or technical performance, by relating the amount of profit or fee payable under the contract to the contractor's performance. Incentive contracts are designed to obtain specific acquisition objectives by: (1) establishing reasonable and attainable targets that are clearly communicated to the contractor; and (2) including appropriate incentive arrangements designed to motivate contractor efforts that might not otherwise be emphasized and discourage contractor inefficiency and waste. When predetermined, formula-type incentives on technical performance or delivery are included, increases in profit or fee are provided only for achievement that surpasses the targets, and decreases are provided for to the extent that such targets are not met. The incentive increases or decreases are applied to performance targets rather than minimum performance requirements. The two basic categories of incentive contracts are fixed-price incentive contracts and cost-reimbursement incentive contracts. (*Source: Federal Acquisition Regulations, Part 2.4*)

Indirect Cost—any cost not directly identified with a single, final cost objective, but identified with two or more final cost objectives or an intermediate cost objective. (*Source: Federal Acquisition Regulations, Part 2.101*)

Inherently Government Activity—a governmental activity that is so intimately related to the public interest that it must be done by federal employees. These functions include those activities that require either the exercise of discretion in applying government authority or the making of value judgments in making decisions for the government. Governmental functions normally fall into two categories: (1) the act of governing, i.e., the discretionary exercise of government authority, and (2) monetary transactions and entitlements. (*Source: GAO/GGD-97-121, 1997; OMB Circular A-76, revised 1999*)

Other Transactional Authority (Space Act Agreements)—NASA is authorized to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate, with: federal agencies, state governments, or territorial governments; persons, firms, associations, corporations, or educational Institutions; foreign

governments and organizations. (Source: 42 U.S.C. 2473 of the National Aeronautics and Space Act of 1958)

Overhead Expense—indirect costs that support a specific part or function of the company but not the whole company.

Performance-Based Contracting—structuring all aspects of an acquisition around the purpose of the work to be performed with the contract requirements set forth in clear, specific, and objective terms with measurable outcomes as opposed to either the manner by which the work is to be performed or broad and imprecise statements of work. (Source: *Federal Acquisition Regulations, Part 2.101*)

Sole-Source Acquisition—a contract for the purchase of supplies or services that is entered into or proposed to be entered into by an agency after soliciting and negotiating with only one source. (Source: *Federal Acquisition Regulations, Part 2.101*)

Time-and-Materials Contract—provides for acquiring supplies or services on the basis of: direct labor hours at specified fixed hourly rates that include wages, overhead, general and administrative expenses, and profit; and materials at cost, including, if appropriate, material handling costs as part of material costs. (Source: *Federal Acquisition Regulations, Part 2.6*)

GOVERNANCE

Asset Sale or Long-Term Lease—an asset sale is the transfer of ownership of government assets, commercial-type enterprises, or functions to the private sector. In general, the government has no role in the financial support, management, or oversight of a sold asset. However, if the asset is sold to a company in an industry with monopolistic characteristics, the government may regulate certain aspects of the business, such as utility rates. (Source: *GAO/GGD-97-121, 1997*)

Employee Stock Ownership Plan (ESOP)—employees take over, or participate in, the management of the organization that employs them by becoming shareholders of stock in that organization. In the public sector, an ESOP can be used in privatizing a service or function. (Source: *GAO/GGD-97-121, 1997*)

Federally Funded Research and Development Center (FFRDC)—activities that are sponsored under a broad charter by a government agency (or agencies) for the purpose of performing, analyzing, integrating, supporting, and/or managing basic or applied

research and/or development, and that receive 70 percent or more of their financial support from the government; and: (1) a long-term relationship is contemplated; (2) most or all of the facilities are owned or funded by the government; and (3) the FFRDC has access to government and supplier data, employees, and facilities beyond that common in a normal contractual relationship. (*Source: Federal Acquisition Regulations, Part 2.101*)

Government Corporation (G-Corp)—separate legal entities that are created by Congress, generally with the intent of conducting revenue-producing commercial-type activities, and that are generally free from certain government restrictions related to personnel and procurement. (*Source: GAO/GGD-97-121, 1997*)

Government Franchise—under the franchising of external services, the government grants a concession or privilege to a private-sector entity to conduct business in a particular market or geographical area. The government may regulate the service level or price, but users of the service pay the provider directly. Under the franchising of internal services, government agencies provide administrative services to other government agencies on a reimbursable basis. (*Source: GAO/GGD-97-121, 1997*)

Government Owned/Contractor Operated (GOCO)—facility owned by a federal agency, but operated in whole or part by private contractor(s).

Government Owned/Private Operated (COPPO)—facility owned by a federal agency, but leased in whole or part to a private operator for its operation and profit.

Government Sponsored Enterprise (GSE)—federally established, privately owned corporations designed to increase the flow of credit to specific economic sectors. GSEs typically receive their financing from private investment, and the credit markets perceive that GSEs have implied federal financial backing. GSEs issue capital stock and short- and long-term debt instruments, issue mortgage-backed securities, fund designated activities, and collect fees for guarantees and other services. GSEs generally do not receive government appropriations. (*Source: GAO/GGD-97-121, 1997*)

Outsourcing—a government entity remains fully responsible for the provision of affected services and maintains control over management decisions, while another entity operates the function or performs the service. This approach includes contracting out, the granting of franchises to private firms, and the use of volunteers to deliver public services. (*Source: GAO/GGD-97-121, 1997*)

Performance-Based Organization—policymaking is to be separated from service operation functions by moving all policymaking responsibilities to a presidential appointee. The service operations are moved to an organization to be headed by a chief executive officer (CEO) hired on a competitive contract for a fixed term. The CEO's contract defines expected performance, and in exchange for being held accountable for achieving performance, the CEO is granted certain flexibilities for human resource management, procurement, and other administrative functions. As of March 1997, several PBOs had been proposed, but no PBO had been authorized in the federal government. (*Source: GAO/GGD-97-121, 1997*)

Public-Private Partnership—sometimes referred to as a joint venture, a contractual arrangement is formed between public- and private-sector partners that can include a variety of activities that involve the private sector in the development, financing, ownership, and operation of a public facility or service. It typically includes infrastructure projects and/or facilities. In such a partnership, public and private resources are pooled and responsibilities divided so that the partners' efforts complement one another. Typically, each partner shares in income resulting from the partnership in direct proportion to the partner's investment. Such a venture, while a contractual arrangement, differs from typical service contracting in that the private-sector partner usually makes a substantial cash, at-risk, equity investment in the project, and the public sector gains access to new revenue or service delivery capacity without having to pay the private-sector partner. Leasing arrangements can be used to facilitate public-private partnerships. (*Source: GAO/GGD-97-121, 1997*)

Privately Owned/Government-Operated (POGO)—facility owned by a private company, but leased by the government for its operations.

Right-sizing—matching capacities (e.g., workforce, infrastructure, launch rates) to program requirements.

HUMAN RESOURCES

Buyout (also known as Voluntary Separation Incentive)—allowed NASA to pay up to \$25,000 as a bonus to employees who resigned or retired during set periods in FY 1994 and FY 1995. The two buyouts spurred over 2,500 voluntary separations. (*Source: NASA Workforce Report*)

Civil Service Retirement System (CSRS)—a defined benefit, contributory retirement system. Employees share in the expense of the annuities to which they become entitled. CSRS benefits are based on the employee's "high-3" average pay and the years of service. Under the general formula, 30 years of service provide 56.25 percent of the "high-3" average salary.

(Source: US Office of Personnel Management, CSRS and FERS Handbook for Personnel and Payroll Offices)

Federal Employees Retirement System (FERS)—is a three-tiered plan consisting of Social Security, a basic FERS annuity, and the Thrift Savings Plan. The basic FERS annuity is based on the employee's length of service and the "high-3" average pay. For most employees, the formula for computing the annual annuity is 1 percent of average pay for each year of creditable service. *(Source: US Office of Personnel Management, CSRS and FERS Handbook for Personnel and Payroll Offices)*

Inherently Governmental Function—a function that is so intimately related to the public interest as to mandate performance by government employees. These functions include those activities that require either the exercise of discretion in applying government authority or the making of value judgments in making decisions for the government. governmental functions normally fall into two categories: (1) the act of governing, i.e., the discretionary exercise of government authority, and (2) monetary transactions and entitlements. An inherently governmental function involves, among other things, the interpretation and execution of the laws of the United States so as to: (a) bind the United States to take or not to take some action by contract, policy, regulation, authorization, order, or otherwise; (b) determine, protect, and advance its economic, political, territorial, property, or other interests by military or diplomatic action, civil or criminal judicial proceedings, contract management, or otherwise; (c) significantly affect the life, liberty, or property of private persons; (d) commission, appoint, direct, or control officers of employees of the United States; or (e) exert ultimate control over the acquisition, use, or disposition of the property, real or personal, tangible or intangible, of the United States, including the collection, control, or disbursement of appropriated and other Federal funds. *(Source: OFPP Policy Letter 92-1, September 23, 1992)*

LIABILITY

1st Party (Property) Insurance—physical damage coverage for assets either owned or in which the insured has a financial interest. Examples would include buildings, autos, homes, and satellites. *(Source: International Space Brokers)*

3rd Party Liability Insurance—protects the insured for its legal liability arising from bodily injury and/or property damage to third parties. An example would be a launch vehicle exploding and injuring or killing

people downrange. Liability insurance would protect the insured from the lawsuits that would inevitably follow. (Source: *International Space Brokers*)

Brokers—act as intermediaries, bringing insured and insurer together. Brokers are not in a risk bearing position. Brokers receive compensation in the form of fees or commission on insurance placed. (Source: *International Space Brokers*)

Capacity—refers to the amount of risk or exposure an underwriter(s) can assume per risk. In space insurance, several underwriters are used in an insurance placement in order to get adequate capacity. (Source: *International Space Brokers*)

Reinsurers—reinsurers simply insure Primary Insurers. Reinsurance allows primary insurers to increase their capacity, or ability to write larger lines. (Source: *International Space Brokers*)

Underwriters—provide terms, conditions, and rates for a particular program. They are in a “risk bearing” position, receiving the actual premium and paying any claims. Sometimes they are referred to as **Primary Insurers**. (Source: *International Space Brokers*)

SHUTTLE RELATED

External Tank (ET)—the largest and heaviest (when loaded) element of the Space Shuttle, the ET has three major components: the forward liquid oxygen tank, an unpressurized intertank that contains most of the electrical components, and the aft liquid hydrogen tank. (Source: NASA, *Shuttle Reference Manual*)

Orbiter—divided into nine major sections: the forward fuselage, which consists of upper and lower sections that fit clamlike around a pressurized crew compartment; wings; midfuselage; payload bay doors; aft fuselage; forward reaction control system; vertical tail; orbital maneuvering system/reaction control system pods; and body flap. (Source: NASA, *Shuttle Reference Manual*)

Solid Rocket Boosters (SRBs)—primary elements of each booster are the motor (including case, propellant, igniter and nozzle), structure, separation systems, operational flight instrumentation, recovery avionics, pyrotechnics, deceleration system, thrust vector control system and range safety destruct system. (Source: NASA, *Shuttle Reference Manual*)

Space Shuttle Main Engine (SSME)—the main engines are reusable, high-performance, liquid-propellant rocket engines with variable thrust. The propellant fuel is liquid hydrogen and the oxidizer is liquid oxygen.

The propellant is carried in separate tanks in the external tank and supplied to the main engines under pressure. (*Source: NASA, Shuttle Reference Manual*)

Space Shuttle System—consists of four primary elements: an orbiter spacecraft, two solid rocket boosters (SRBs), an external tank to house fuel and oxidizer, and three Space Shuttle main engines. (*Source: NASA, Shuttle Reference Manual*)

Space Transportation System (STS)—the overall Shuttle program is called the Space Transportation System. (*Source: NASA, Shuttle Reference Manual*)

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